Claims

What is claimed is:

1. A method for forming a plurality of channels in a substrate, the method comprising:
   (a) depositing a first masking material on a substrate having a first region at a first level and a second region at a second level higher than the first level;
   (b) etching the first masking material from the substrate to produce a first sidewall extending from the substrate at an intersection of the first and second regions;
   (c) depositing, on the substrate, a second masking material different from the first mask material, the second masking material covering the first and second regions and the first sidewall;
   (d) etching the second masking material from the substrate to produce a second sidewall adjacent to the first sidewall, the first and second sidewalls having pitches on the order of nanometers;
   (e) repeating steps (a)-(d) a predetermined number of times to produce a plurality of adjacent nanometer-pitched sidewalls alternatingly formed of the first and second masking materials;
   (f) selectively etching one of the first and second masking materials from the substrate, leaving sidewalls formed of the masking material remaining on the substrate, the sidewalls being spaced from each other on the substrate by nanometer-scale dimensions; and
   (g) etching regions of the substrate between the sidewalls to form a plurality of channels in the substrate spaced from each other by nanometer-scale dimensions.
2. The method of claim 1 wherein depositing a first masking material on a substrate includes depositing the first masking material on the substrate with the first degree of anisotropy and wherein etching the first masking

material from the substrate includes etching the first masking material from the substrate with a second degree of anisotropy being different from the first degree of anisotropy.

3. The method of claim 2 wherein depositing and etching the first masking material from the substrate with different degrees of anisotropy includes depositing the first masking material with a greater thickness in the vertical direction at the intersection of the first and second regions of the substrate than the thickness of the first masking material in the first and second regions and uniformly etching the first masking material from the substrate in the vertical direction, thereby producing the first sidewall.

4. The method of claim 1 wherein etching the first and second masking material from the substrate includes etching the first and second masking materials using photolithography.

5. The method of claim 1 wherein depositing a second masking material on the substrate includes depositing the second masking material on the substrate with a first degree of anisotropy and wherein etching the second masking material from the substrate includes etching the second masking material from the substrate with a second degree of anisotropy being different from the first degree of anisotropy.

6. The method of claim 5 wherein depositing and etching the second masking material from the substrate with different degrees of anisotropy includes depositing the second masking material with a greater thickness in the vertical direction in an area adjacent to the first sidewall than the thickness of the second masking material in the first and second regions and uniformly etching the second masking material from the substrate in the vertical direction, thereby producing the second sidewall.

7. The method of claim 1 wherein selectively etching one of the first and second mask materials from the substrate etching the selected masking material using photolithography.

8. The method of claim 1 wherein spacing between the channels is uniform.

9. The method of claim 1 wherein spacing between the channels is non-uniform.

10. The method of claim 1 wherein forming a plurality of channels in the substrate includes forming a plurality of structures in substrate separated by the channels wherein the structures are spaced from each other by nanometer-scale dimensions and being of uniform thickness.

11. The method of claim 1 wherein forming a plurality of channels in the substrate includes forming a plurality of structures in substrate separated by the channels wherein the structures are spaced from each other by nanometer-scale dimensions and being of non-uniform thickness.

12. The method of claim 1 wherein the first and second sidewalls and the channels are spaced from each other by decananometer-scale dimensions.

13. A plurality of multi-periodic, nanometer-scale semiconductor devices formed using the method of claim 1.

14. A plurality of multi-periodic, nanometer-scale electromechanical devices formed using the method of claim 1.

15. A method for forming a channel of nanometer-scale dimensions in a substrate, the method comprising:

(a) forming a first sidewall of first masking material on a substrate, the first sidewall having nanometer-scale width;

(b) depositing a second masking material on the substrate, such that the second masking material covers the first sidewall with a first thickness, forms second and third sidewalls on first and second sides of the first line with a second thickness being less than the first thickness, and covers the substrate in regions adjacent to the second and third sidewalls with the first thickness;

(c) etching portions of the second and third sidewalls from the substrate such that the first and second sides of the first sidewall form discontinuities in the second masking material;

(d) removing the first sidewall from the substrate leaving a channel in

the second masking material having substantially the same width as the first sidewall; and

(e) etching a channel in the substrate corresponding to the channel in the second masking material.

16. The method of claim 15 wherein forming a first sidewall of first masking material of nanometer-scale dimensions on a substrate includes forming the first sidewall using edge definition lithography.

17. The method of claim 15 wherein etching portions of the second and third sidewalls from the substrate includes leaving a substantially uniform thickness deposit of the second masking material on the substrate in areas where the second and third sidewalls were present.

18. The method of claim 15 wherein etching portions of the second and third sidewalls from the substrate includes etching portions of the sidewalls using photolithography.

19. The method of claim 15 wherein removing the first sidewall from the substrate includes removing the first sidewall using a lift off method.

20. The method of claim 15 comprising forming a fourth sidewall of nanometer-scale dimensions in the channel.

21. The method of claim 20 comprising forming fifth and sixth sidewalls of nanometer-scale dimensions on opposite sides of the fourth sidewall to form a mushroom-shaped structure.

22. The method of claim 21 wherein the mushroom-shaped structure comprises a gate material for a semiconductor device.

23. A semiconductor device formed using the method of claim 22.

24. A semiconductor device formed using the method of claim 15.